is used. It is something of a drawback to the book that the work of Dupree, which is an extension of the method originally proposed by Klimontovich, is not included. Dupree's procedure allows even further simplification and physical insight.

A pleasant factor of the book is the use and coherent description of "fast" and "slow" scales in both space and time. Many of these motions follow from the pioneering work of Bogoliubov in nonlinear dynamics and fall naturally into the task of constructing various types of kinetic equations.

The latter part of the book is concerned with the inclusion in the theory of plasma radiation in the form of Cerenkov emission of plasma waves from high-velocity particles. This leads naturally to the construction of equations governing quasi-linear theory, and even to the construction of a form of plasma hydrodynamics including these effects. In addition, in many cases, the author includes the effects of static magnetic fields.

The book as a whole is well written, and even though the algebra sometimes becomes a bit formidable, the author continually gives a great deal of physical insight into the processes involved. It should be a necessary purchase for all serious plasma physicists.

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Electronic Properties

Physics and Chemistry of the Organic Solid State. Vol. 3. DAVID FOX, MORTIMER M. LABES, and ARNOLD WEISSBERGER, Eds. Interscience (Wiley), New York, 1967. xiv + 520 pp., illus. $19.95.

This book is a splendid addition to the first two volumes of this series. It presents a critical review of progress, up to early 1966, in the field of exciton and charge-carrier generation and migration in organic solids, as well as that of photosensitization.

The book has four main divisions. The first, written by W. Helfrich, deals with steady-state and transient space-charge-limited and volume-controlled currents in organic solids such as anthracene, the polyphenyls, and the phthalocyanines. It is an excellent exposition of the most significant work that has been done on the flow, recombination, mobility, and trapping of carriers in organic crystals. Single-injection, double-injection, and recombination luminescence are discussed. The explanatory material is useful and clear. If the references are followed, it is possible for a beginner to encompass the entire state of the art in this field.

The second division, written by J. Bourdon and B. Schnuriger, deals with photosensitization of organic solids, and also provides a well-balanced presentation of the chemical and physical effects induced in a host by the addition of guest molecules either at the surface or in the bulk; the guest molecules either absorb light at longer wavelengths than the host can absorb and utilize, or increase the quantum yield of the absorbed light. Polymers and glasses are also included in the discussion. The photosensitization phenomena covered include charge-carrier production and luminescence, oxidation, polymerization and cross-linking, and photochromism. The list of references is especially good and fairly complete (the work done in this laboratory is not cited).

The third division, written by O. LeBlanc, Jr., is what I consider to be the most useful review of dark and photoconductivity in organic crystals available, certainly for the period reviewed, and even to this date. There have been thousands of experiments performed in this field, and there are quite a few that have not been interpreted properly. The author makes a seasoned, and in my view well-founded, selection and discussion of important experiments and in so doing performs a valuable service to those who are just entering this field. The materials covered include homomolecular (a good choice of a word) crystals such as anthracene, and also dyes, charge-transfer complexes, and TCNQ anion-radical salts. The subjects covered include the energetics of carrier generation in the dark and in the presence of light; carrier transport, trapping, and recombination; and electrode contacts.

The fourth division, written by S. A. Rice and J. Jortner, is a small book in itself, although it is entitled merely "Comments on the theory of exciton states in homomolecular crystals." It is a selective and superb review of the literature dealing with the theory of the interaction of a radiation field with a crystal lattice. The authors discuss among other things the nature of the low-lying electronically excited states of crystals of aromatic molecules; exciton transport and decay, interactions with other excitons, and ionization (including a discussion of photoconductivity); the properties of crystal excitations that are intermediate between the Frenkel and the Wannier excitons; and impurity states in molecular crystals, including mixed molecular crystals.

This book is primarily directed toward specialists but is so well written and selective in the material it includes that it can serve as a starting point for anyone who plans to enter the field.

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Radiation and Photochemistry

The Chemistry of Ionization and Excitation. Proceedings of a conference on radiation chemistry and photochemistry, Newcastle upon Tyne, Great Britain, Sept. 1966. G. R. A. JOHNSON and G. SCHOLES, Eds. Taylor and Francis, London, 1967. xvi + 328 pp., illus. $11.50.

For decades radiation chemists have made subtle advances toward photochemistry; the difference between the two disciplines is always apparent, but just what can be achieved by a liaison between the two always remains a golden promise. The conference at Newcastle, England, whose proceedings are published in *The Chemistry of Ionization and Excitation* is the most recent attempt to get photochemists and radiation chemists together. Surprisingly enough, at least a partial success is achieved, as some of the contributors made a genuine attempt to extrapolate their work into the other field.

The first section consists of review papers which present the current viewpoints in radiation chemistry, with appropriate emphasis placed on the role played by excited molecules. This, together with the paper outlining the optical approximation in radiation chemistry, gives the photochemist a clear idea of the role he might play in the chemistry of high-energy radiations.

The subsequent sections deal with the radiolysis of gases, organic liquids, and water. The papers presented are in the mainstream of current research, and in a short space give a reasonably balanced view of these fields. The supporting photochemistry is of great interest to the radiation chemist; in particular, the papers on the photochemistry of water and rigid organic media and on the photoionization of gases are note-

worthy. The section dealing with the radiolysis of water is particularly well represented by both the ^{60}Co γ-ray and pulse radiolysis techniques. The different papers are all good examples of the type of approach used to study the radiolysis of water. There are papers on the nature of the processes leading to the formation of molecular products, a controversial issue right now. The rate processes of the primary species in water are measured and discussed, together with an interesting treatise on the reactions of hydrated electrons.

The book is dedicated to J. J. Weiss, who has been "from youth to age of unusual strength" in both fields of research. It is a worthy tribute to his many contributions, and I recommend it to all radiation chemists, and to photochemists who have a passing interest in the chemistry created by ionizing radiation.

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The Three-Body Problem

Theory of Orbits. The Restricted Problem of Three Bodies. VICTOR SZEBEHELY. Academic Press, New York, 1967. xvi + 668 pp., illus. $25.

The subtitle of this book more closely characterizes its contents than does the title. Chapter 1 gives a carefully delineated mathematical description of the restricted problem of three bodies. Chapter 2 considers the various possibilities in the reduction of the order of the system of differential equations. Chapter 3 treats regularization as it may be applied to the restricted problem. Chapter 4 treats the totality of solutions, the zero-velocity curves, and regions of motion in various cases. There are 17 pages of tables, giving specific numerical results. Chapter 5 deals with motion near the equilibrium points and with stability, including some nonlinear phenomena. Chapter 6 is a relatively short treatment of Hamiltonian dynamics in the extended phase space. It serves as preparation for a chapter on canonical transformations of the restricted problem. Chapter 8, on periodic orbits, was almost omitted from the book, the author tells us, but he steers deftly across a broad sea of information (which is much better for the reader than the trite excuse "beyond the scope of this book"). Chapter 9, on numerical explorations, is the longest one; it provides a well-balanced coverage of the history of results down to the present time. The final chapter, on modifications of the restricted problem, deals with the three-dimensional case, the elliptic case, Hill's problem, and the problem of Euler-Lagrange.

As a textbook, whether for a formal course or not, this is a remarkable book. I am reminded of the succinct advice for a public speaker: "Stand up; tell them what you are going to tell them—tell them—then tell them what you told them." Each chapter opens with a few paragraphs that set the stage for the material it contains. Each chapter ends with notes, certainly the most interesting part of the book and, except for the extensive list of references, probably the most valuable part for the reader. On every page, one feels the author, the teacher, hovering intently over the reader, his student, to make sure he is getting every point as completely as possible. One is impressed with the extensive detail and erudition of this field which the author commands. He treats both the classical problems of astronomy and the modern problems of the space age with great depth and clarity. This is the kind of book every good teacher would be proud to publish in his own field, and the author may well take delight in his accomplishment.

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Luminescence

Fluorescence: Theory, Instrumentation, and Practice. Based on an American Chemical Society symposium, Miami Beach, Fla., April 1967. GEORGE G. GUILBAULT, Ed. Dekker, New York, 1967. xxviii + 697 pp., illus. $15.75.

This book is a collection of 14 papers presented at a symposium organized by the Analytical Division of the American Chemical Society. It is not easy to summarize a book like this in a short review, since the papers vary widely in their emphasis and outlook. Many are review papers which present good overall views of a particular area, whereas others are more concerned with the work of the authors' own laboratories.

The papers can be roughly divided into four groups: two general papers dealing with the influence of structure and environment on electronic states, energies, and luminescence yields; five papers best described as treating the applicability of particular techniques of luminescence measurements; two papers describing new instruments for specialized fluorescence measurements; and five papers reporting on specific problems which have been studied by fluorescence techniques.

Judged as a collection of scientific papers, this book certainly belongs in any scientific library. But I am more concerned with its value as a reference book for a scientist or a laboratory engaged in luminescence research. From this point of view, the meat of the book is in the first two groups of papers mentioned above, and the value of any paper is largely measured by its comprehensiveness. The two papers in the first group, by E. L. Wehry and M. Kasha, together give a fairly complete summary of various factors that are known to affect fluorescence measurements. The value of the papers in the second group lies in the fact that they can suggest powerful techniques for attacking many different research problems. The chapters that I believe will be found especially useful are the one on use of energy transfer (by F. Wilkinson, largely describing the work of the late J. T. Dubois), and the paper on phosphorimetry by W. J. McCarthy and J. D. Winefordner. Both of these are also quite complete in their treatment.

The book as a whole is not, however, a comprehensive work on fluorescence, since it covers only a limited set of topics in this broad area. There is, for example, little or no discussion of such important matters as luminescence of molecular crystals, fluorescence lifetimes, or the fluorescence of large molecules in the gas phase. Unfortunately, no really comprehensive work on luminescence is available, so its place in the laboratory must be filled by other books such as this one. On the whole, I expect the book to be useful in my own work in spite of its limitations, and I believe that others will also find it useful.

A couple of other points perhaps deserve mention. The book is reproduced directly from a typed manuscript, so its 700 pages are comparable to about 300 pages of the usual printed book. It does include an excellent index, which is essential in locating specific information in a book of this type.

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